

YUKON RIVER SALMON TAGGING STUDIES

1967

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YUKON RIVER TAG AND RECOVERY STUDY

INTRODUCTION

Salmon tag and recovery studies in the Yukon River date back to 1961 when a two-year crash program utilizing Federal funds for an investigation of chum salmon was initiated. Since 1963, tag and recovery studies have been mainly concerned with gathering information on the king salmon run which is more intensively harvested by commercial fishermen. Prior to 1967, a total of 7,600 chum and 2,270 king salmon had been tagged and released.

In 1967 king and chum salmon were tagged at two sites, Flat Island and Middle Mouth as part of the present study. Salmon have been tagged at the Flat Island site since 1963 which is located in the South Mouth approximately five miles northwest of Sheldons Point. The Middle Mouth site, established in 1966, is located near Willie Moore's Camp in the Middle Mouth. Figures 2 and 3 are maps of the lower Yukon River showing locations of tagging sites, villages and commercial catch statistical areas.

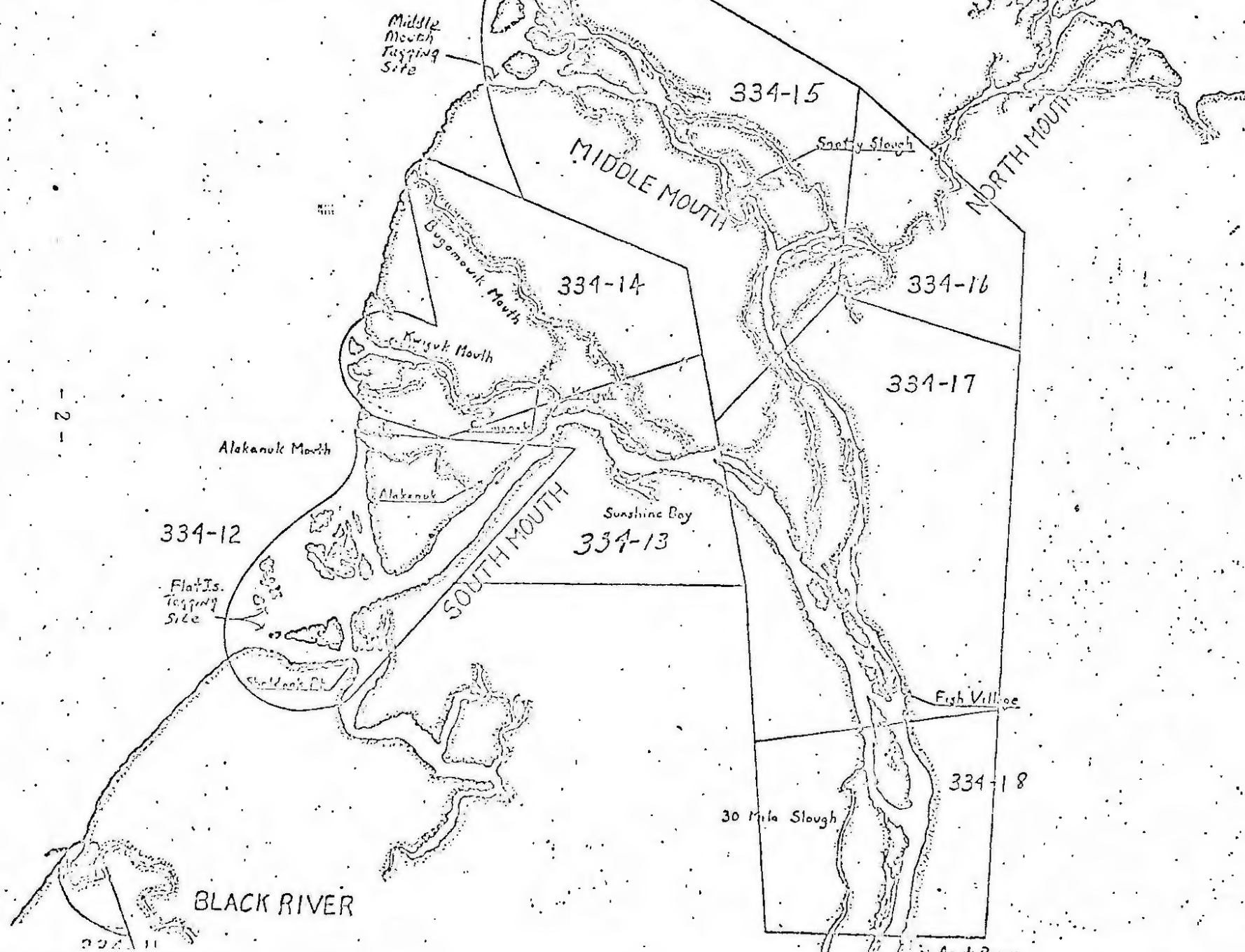
The objectives of this study were the determination of: (1) population size and percentage utilization by the commercial fishery of the king salmon run, (2) destination and timing of run segments or races in the king and chum salmon runs, and (3) abundance indices for king and chum salmon runs. Information relating to the third objective (abundance indices) as well as a discussion of capture gear efficiency will be presented in a future report.

METHODS

Set gill nets of varying mesh sizes (5-1/2", 7", 8-1/2" stretched measure) were fished for the purpose of capturing salmon for tagging at the Flat Island (South Mouth) site. In addition, a beach seine trap was experimentally fished for several days at the northwestern end of Flat Island. Fishing gear was operated at or near both shores of the South Mouth. Only set gill nets of 8-1/2" stretched mesh were operated at the Middle Mouth site.

Captured salmon were tagged with spaghetti tags consisting of 13 inch lengths of yellow plastic tubing, 1/16 inch in diameter. These tags were placed in the fish with a special needle applicator approximately one inch below and slightly forward of the insertion of the dorsal fin. The tag legend included reward information and the mailing address of the Anchorage office of the Alaska Department of Fish and Game.

Figure 2. Yukon River, mouth to Anuk River.



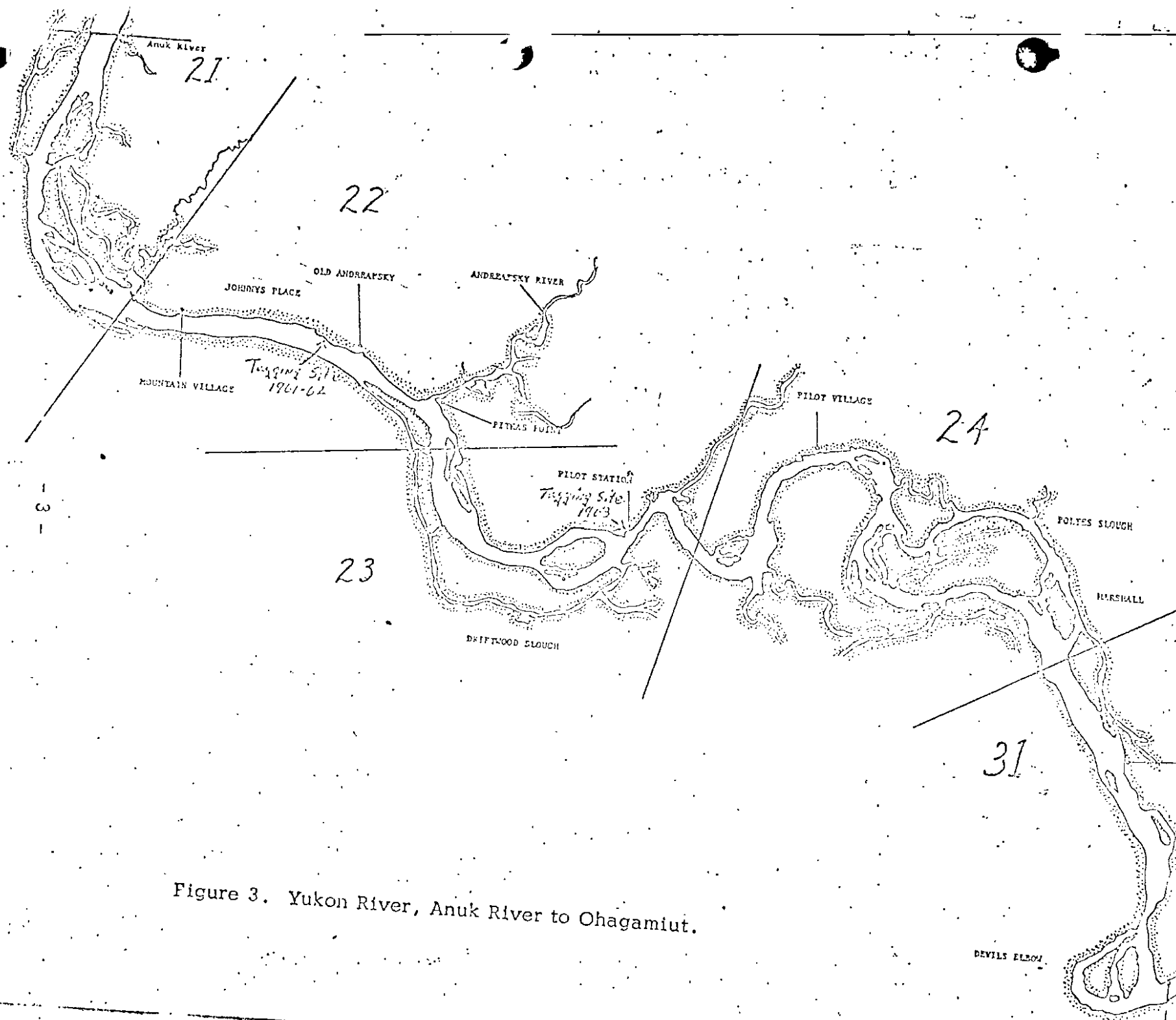


Figure 3. Yukon River, Anuk River to Ohagamiut.

Recoveries of tagged salmon were obtained from commercial and subsistence fishermen throughout the drainage. A one-dollar reward was offered for each tag recovery and publicity notices were posted in every village throughout the Alaskan portion of the drainage. Canadian Department of Fisheries personnel collected tag recoveries in Yukon Territory. Most of the tag recoveries were attached to fish ticket copies that were turned in to the Department by various processors. These fish tickets are completed when salmon deliveries are made to tender boats or shore plants and show the fisherman's name, date of catch and statistical area of catch. Other recoveries were either collected by Department personnel or were mailed to the Anchorage office by fishermen.

The sex and snout to fork length were recorded for every salmon tagged. Each tagged salmon was classified as to its condition upon release. Fish classified as Category 1 were considered in good condition, Category 2 consisted of fish of questionable condition, and Category 3 fish were considered to have been released in poor condition. Salmon that were taken from the net in very poor condition, e.g., bleeding from the gills, were not tagged, but were sampled for age-sex-size information and then were given to local processors or subsistence fishermen.

RESULTS

King Salmon

As shown in Table 1, a total of 1,148 king salmon was captured at both tagging sites of which 724 were tagged. There were 383 king salmon tagged at the Flat Island site and 341 tagged at the Middle Mouth site. Table 1 also shows the numbers of recoveries made by tagging date.

The 1967 recovery rates were 30.0 percent (n=115) for Flat Island tags and 37.0 percent (n=126) for Middle Mouth tags for a combined value of 33.0 percent. Of the 241 recoveries, 228 or 95 percent were captured in king salmon gill nets (8-1/2 inch stretch mesh). This does not include recaptures made by tagging site gear.

Table 2 compares the percentages of tagged salmon released to commercial catches by fishing period. These data included tags out for both sites and commercial catches made in the vicinity of the tagging sites (statistical areas 334-12 and 334-15). This comparison shows that relatively few tagged salmon were released during the first two periods, but releases after June 7 generally reflected salmon abundance as indicated by commercial catches.

TABLE 1

NUMBERS OF YUKON RIVER KING SALMON TAGGED, CAPTURED AND RECOVERED
DURING 1967

Date	Flat Island Site			Middle Mouth Site			Combined Sites			Recoveries of Tags Only		
	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Flat Island	Middle Mouth	Total
5/30	0	0	0				0	0	0	0		0
31	0	0	0				0	0	0	0		0
6/1	0	0	0				0	0	0	0		0
2	0	0	0				0	0	0	0		0
3	2	1	3				2	1	3	0		0
4	7	3	10				7	3	10	3		3
5	36	20	56	24	7	31	60	27	87	14	11	25
6	33	5	38	2	6	8	35	11	46	19	0	19
7	8	4	12	1	0	1	9	4	13	3	0	3
8	35	10	45	36	16	52	71	26	97	16	8	24
9	1	0	1	0	0	0	1	0	1	0	0	0
10	9	3	12	5	0	5	14	3	17	6	2	8
11	24	10	34	39	21	60	63	31	94	14	13	27
12	9	4	13	39	8	47	48	12	60	5	17	22
13	21	6	27	2	1	3	23	7	30	5	1	6
14	5	0	5	1	0	1	6	0	6	1	0	1
15	11	4	15	1	0	1	12	4	16	3	0	3
16	0	2	2	0	0	0	0	2	2	0	0	0
17	0	0	0	8	0	8	8	0	8	0	6	6
18	16	4	20	80	29	109	96	33	129	1	49	50
19	6	1	7	5	0	5	11	1	12	1	2	3
20	1	0	1	0	1	1	1	1	2	1	0	1
21	20	9	29	2	1	3	22	10	32	3	0	3
22	9	4	13	4	8	12	13	12	25	4	1	5
23	4	4	8	0	0	0	4	4	8	1	0	1
24	25	11	36	1	2	3	26	13	39	5	0	5
25	16	5	21	17	9	26	33	14	47	5	1	6
26	3	3	6	22	5	27	25	8	33	1	6	7
27	9	7	16	27	21	48	36	28	64	1	5	6

TABLE 1 (Continued)

NUMBERS OF YUKON RIVER KING SALMON TAGGED, CAPTURED AND RECOVERED
DURING 1967

Date	Flat Island Site			Middle Mouth Site			Combined Sites			Recoveries of Tags Out		
	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Numbers Tagged	Numbers Untagged	Total Catch	Flat Island	Middle Mouth	Total
6/28	10	15	25	9	35	44	19	50	69	1	1	2
29	9	6	15	10	22	32	19	28	47	1	1	2
30	6	8	14	0	8	8	6	16	22	0	0	0
7/ 1	7	1	8	0	1	1	7	2	9	0	0	0
2	27	34	61	3	10	13	30	44	74	1	0	1
3	3	4	7	0	2	2	3	6	9	0	0	0
4	4	5	9	3	1	4	7	6	13	0	2	2
5	2	8	10	0	1	1	2	9	11	0	0	0
6	1	1	2	0	2	2	1	3	4	0	0	0
7	1	4	5				1	4	5	0		0
8	0	0	0				0	0	0	0		0
9	3	1	4				3	1	4	0		0
Totals	383	207	590	341	217	558	724	424	1,148	115 (30.0)	126 (37.0)	241 (33.3)

/ Figures in parenthesis represent recovery percentages of tags out.

TABLE 2

COMPARISONS OF PERCENTAGES OF
SALMON TAGGED TO COMMERCIAL CATCHES
BY FISHING PERIOD, 1967^{1/}

Fishing Period	Percentages of Catch : Tags Out ^{2/}	Percentages of Cumulative Catch : Cumulative Tags Out ^{2/}
6/1-6/3	5.0 : 0.0	5.0 : 0.0
6/5-6/7	39.0 : 18.0	44.0 : 18.0
6/8-6/10	4.0 : 14.0	48.0 : 32.0
6/12-6/14	19.0 : 22.0	67.0 : 54.0
6/15-6/17	3.0 : 3.0	70.0 : 57.0
6/19-6/21	19.0 : 21.0	89.0 : 78.0
6/22-6/24	9.0 : 7.0	98.0 : 85.0
6/26-6/27	2.0 : 15.0	100.0 : 100.0

^{1/} Includes both Flat Island and Middle Mouth tags. Includes commercial catches from area 334-12 and 334-15.

^{2/} Number of tags out at end of fishing period; for example, tags out for period 6/12-14 include tags out for 6/11-14.

Table 3 lists recoveries by area and tagging date. As shown in this table, recovery rates declined after June 21. For example, the recovery rate for both sites was 43 percent during June 1-20 and 16 percent during June 21-July 10. This decline was a result of the commercial fishery closure in the lower 150 miles of river that was effective June 27.

Differences Between Recovery Rates: Several differences were noted in the recovery data for each site:

1. A greater percentage of Middle Mouth tags was recovered compared to Flat Island tags, 37.0 percent versus 30.0 percent (Table 1).
2. A majority of the Flat Island tags was recovered below Fish Village (70%), while recoveries of Middle Mouth tags were divided nearly equally above and below Fish Village.
3. The ratio of Flat Island recoveries to catch differed more greatly for various areas of the river than the Middle Mouth recoveries (see Table 4).

Several factors probably caused the above differences:

1. Differential tagging mortality could affect the recovery rates. However, about 20 percent of the Flat Island releases would have had to sustain tagging mortality to account solely for the differences noted.
2. Commercial fishing is usually allowed for two 48-hour periods each week of the season. The timing of the runs to the various mouths of the river may vary several days which may result in differences of actual harvest rates.
3. A much greater amount of gear is fished in the South Mouth, especially near the Flat Island tagging site as compared to the Middle Mouth.

Distribution of Upriver Tag Recoveries by Tagging Date: It had been suspected but never shown that the Yukon king salmon run was composed of separate races bound for different spawning areas, each possibly differing in run timing, relative abundance, productivity, etc. A tag and recovery program is one possible method of identifying and separating these races, assuming they differ in timing and destination. Similar to those conditions found in other large river systems (Columbia, Sacramento Rivers), it was assumed that Yukon

TABLE 3

RECOVERIES OF YUKON RIVER TAGGED KING SALMON BY AREA AND TAGGING
DATE DURING 1967

General Recovery Area	Mileages From Tagging Sites	6/1-10		6/11-20		6/21-30		7/1-10		Total Recoveries			
		1/	2/	1/	2/	1/	2/	1/	2/	1/	2/	Both Sites	
<u>South Mouth</u>													
Below Flat Island		5		4		1				10		10	
Flat Island (Tagging Site)	0	20		9		3				32		32	
Flat Island-Alakanuk	1-11	11		9		3		1		23	1	24	
Alakanuk	17	1		1	1			1		3	1	4	
Kwiguk-Emmonak	24	8		1						9		9	
Aproka-Kwikpak Passes	30-43	1								1		1	
<u>Middle Mouth</u>													
Willie Moore's Camp (Tagging Site)	0		8		19		3				30	30	
Willie Moore's Camp-Snotty Slough	2-15		2		2		1				5	5	
Snotty Slough	20			1	3					1	3	4	
Aproka Pass	25-40	2	1		16		4			2	21	23	
New Hamilton	40				1						1	1	
<u>Bugomowik Channel</u>													
Mouth			2		2						4	4	
<u>Main River</u>													
Fish Village-Anuk River	52-63	8	3	3	23	4		1		15	27	42	
Patsys Cabin-Mt. Village	71-90	1	2		4	3				4	6	10	
Old Andreafsky	97		1		2	1				1	3	4	
Mouth of Andreafsky River	104						1				1	1	
Goose Island	109				2						2	2	
Pilot Station	114-122	2		1	3	1	1			4	4	8	

TABLE 3 (CONTINUED)

RECOVERIES OF YUKON RIVER TAGGED KING SALMON BY AREA AND TAGGING
DATE DURING 1967

General Recovery Area	Mileages From Tagging Sites	6/1-10		6/11-20		6/21-30		7/1-10		Total Recoveries		
		1/	2/	1/	2/	1/	2/	1/	2/	1/	2/	Both Sit
Pilot Village	130-138			1	1					1	1	2
Pilot Village-Marshall	142-150	1		1	1		1			2	2	4
Marshall	161				1		1				2	2
Palmit	251				1	1				1	1	2
Holy Cross	261-279		1		1	1	2			1	4	5
Nulato	484					1	1			1	1	2
Ruby	581				1						1	1
Kokrines	606				1						1	1
Kallands	665					1				1		1
Rampart-Stevens Village	817				1	1				1	1	2
Fort Yukon	986-1002	1			1					1	1	2
<u>Innoko River</u>												
Shageluk	328					1				1		1
<u>Recovery Location Unknown</u>			1		1						2	2
Total Recoveries		61	21	31	88	22	15	1	2	115	126	241
Percentage Recovery of Tags Out		46.6	30.9	33.3	50.3	19.8	16.3	2.1	33.3	30.0	37.0	33.3

1/ Tagged at Flat Island

2/ " " Middle Mouth

TABLE 4

RELATION OF TAG RECOVERIES TO KING SALMON
CATCHES FOR VARIOUS AREAS OF THE
YUKON RIVER, 1967
(INCLUDES YUKON TERRITORY CATCHES)

	Total Recoveries	Total Catch ^{1/}	Numbers of Recoveries: Catch	Percentage of Recoveries: Catch
<u>Flat Island Tags</u>				
334-12 through 334-13	78	33,508	1:430	69:31
334-17 through 334-24	28	55,736	1:1,990	25:52
334-31 through Holy Cross	2	8,489	1:4,244	2:8
Above Holy Cross	5	9,508	1:1,902	4:9
Totals	113	107,241	1:949	100:100
<u>Middle Mouth Tags</u>				
334-15	38	27,158	1:714	33:27
334-17 through 334-24	70	55,736	1:796	59:56
334-31 through Holy Cross	5	8,489	1:1,697	4:8
Above Holy Cross	5	9,508	1:1,902	4:9
Totals	118	100,891	1:855	100:100
<u>Total Tags, Total Catches</u>				
Mouths through 334-24	224	131,239	1:586	93:88
334-31 through Holy Cross	7	8,489	1:1,213	3:6
Above Holy Cross	10	9,508	1:951	4:6
Totals	241	149,236	1:619	100:100

^{1/} Includes both commercial and subsistence catches.

king salmon bound for the upper portions of the drainage may have migrated earlier in the season. The majority of salmon migrating above Mile 484 (Nulato) were believed to be bound for Canada and the Tanana and Koyukuk River drainages in Alaska.

Table 5 shows the number of recoveries made by tagging date (10-day periods) for the area above Mile 484 during 1962, 1963 and 1965 to 1967. The 1964 data was not used due to the unusual late season and entry of the run into the river that year. The 1963 and 1965 to 1967 data represent salmon tagged at the river mouth (Mile 0) while in 1962 salmon were tagged at Mile 96. For comparative purposes, the grouping of the 1962 recoveries was obtained by subtracting 5 days from each tagging date (assuming a migration rate of king salmon of about 20 miles a day). In addition, the percentages of total tags applied and total recoveries made above 484 during each tagging period are compared in Table 5.

Seven recoveries were made above Mile 484 in 1967. Of these, four were tagged during June 17 and 18, two were tagged on June 24 and one was tagged on June 8. Tagging dates for salmon recovered above Mile 484 have ranged from June 8 to June 30 during the five year period with the majority of recoveries having been tagged during June 11 to June 20. However, the limited data shows that the percentage of total recoveries for each tagging period was dependent on the numbers tagged, and there was no indication that king salmon bound for the upper river migrated early in the season.

Recovery of King Salmon Classified as to Condition: Table 6 compares upstream recoveries of tagged salmon according to their condition upon release. The data do not include those recoveries made at or below the tagging sites. Salmon classified as Condition 2 and 3 had lower recovery rates when compared to the Condition 1 group. This same tendency was evident in previous studies which indicated a higher mortality rate of Condition 2 and 3 tagged salmon after release. This should be taken into account in population estimates or harvest rate computations.

Population Estimate Considerations: Any population estimate of Yukon River king salmon using present methods must take the following into consideration:

1. Relatively small numbers were tagged and recovered. In addition, many salmon entering Kwiguk, Alakanuk, Bugomowik, North Mouth, etc., channels were not tagged.
2. Non-random tagging and recovery:

TABLE 5

TAGGING DATES OF YUKON RIVER KING SALMON RECOVERIES MADE
ABOVE MILE 484 DURING 1962, 1963 AND 1965-1967

Tagging Dates	Number of Recoveries					Total	Percentage of	
	1962	1963	1965	1966	1967		Total Recoveries ^{1/}	Total Tags ^{2/}
June 1-10	0	0	1	0	1	2	6.5	10.0
June 11-20	3	5	2	4	4	18	58.0	51.6
June 21-30	6	0	2	1	2	11	35.5	33.5
July 1-10	0	0	0	0	0	0	0.0	4.5
July 11-20	0	0	0	0	0	0	0.0	0.3
July 21 +	0	0	0	0	0	0	0.0	0.1
Totals	9	5	5	5	7	31	100.0%	100.0%

^{1/} Recoveries above Mile 484

^{2/} Total Tags applied at all tagging sites

TABLE 6

PERCENTAGE UPSTREAM RECOVERY FOR YUKON RIVER TAGGED KING SALMON
CLASSIFIED AS TO CONDITION DURING 1967 ^{1/}

Condition Classification	Numbers Tagged			Percentage Recovery		
	F.I.	M.M.	Total	F.I.	M.M.	Total
1	236	177	413	23.7	32.8	27.6
2	85	81	166	17.6	27.2	22.3
3	14	48	62	7.0	22.9	19.4
Unclassified	8	2	10	37.5	100.0	50.0
Totals	343	308	651	21.9	30.2	25.8

F.I. Flat Island Site

M.M. Middle Mouth Site

^{1/} Includes only those tags recovered above tagging sites (upstream recoveries)

- (a) Salmon were not always tagged in proportion to their relative abundance.
- (b) Gear selectivity: Tagging site gear, mainly 8-1/2 inch mesh nets, sampled a somewhat different age, sex and size segment of the run than did the upper river fishwheel fishery.
- (c) Tagged fish are more susceptible to capture in the lower river. This is a result of milling of tagged fish caused by their disorientation or weakened condition.
- (d) Tagged fish may not be randomly distributed with the untagged portion of the population. This would be especially true for recoveries made in the vicinity of the tagging sites.

3. Mortality of tagged salmon: Although salmon with bleeding gills or in a very weakened condition were not tagged, it is probable that a few died as a result of the tagging and handling operation.

4. Unreported tag recoveries.

A number of simple Petersen estimates of the 1967 run were made using different tag, recovery and catch data. Some of the different sets of data used were as follows:

- 1. All tags out and all recoveries; total commercial and subsistence catch for drainage (total catch).
- 2. All tags out; all subdistrict #1 recoveries and subdistrict #1 total catch.
- 3. Condition 1 and 2 tags only; all recoveries above tagging sites; total catch above tagging sites.
- 4. Same as number 3, but only recoveries and commercial catch by 8-1/2 inch gill nets in subdistrict #1.

The estimates varied from 397,000 to 600,000 king salmon. The low and high estimates resulted from methods 2 and 4 respectively. Similar estimates made for the 1966 run varied from 310,000 to 387,000. These population estimates are probably too high as a result of biases already mentioned (unreported tag recoveries, mortality of tagged fish, etc.).

Because of difficulties associated with the capture, tagging and recovery of salmon, the entire tag and recovery operation will be moved above the main commercial fishery in 1968. Salmon will be tagged and released in the vicinity of Ohagamut (Mile 185) and Department gear will be operated in the Russian Mission to Holy Cross area (Mile 213 - 279) for the purpose of obtaining tagged to untagged ratios. Commercial and subsistence catches in the latter area will also be closely monitored by Department personnel in order to obtain additional tagged to untagged ratios.

RESULTS

Chum Salmon

Most chum salmon were captured incidentally to king salmon as tagging site gear consisted mainly of 8-1/2 inch mesh gill nets. As shown in Table 7, a total of 1,293 chum salmon was captured at both sites of which 527 were tagged. There were 357 chum salmon tagged at the Flat Island site and 170 tagged at the Middle Mouth site.

Table 8 shows the area of recovery for all 1967 tag recoveries. A total of 27 or 5.1 percent of the tags out were recovered. Recovery rates for chum salmon tagged and released in the vicinity of the river mouth during the 1963-1967 period have ranged from 4.0 percent in 1966 to 11.9 percent in 1963.

Kuskokwim River Tagging

A pilot tagging study was also initiated on the Kuskokwim River king salmon in 1967. The results of the preliminary study have not yet been completely analyzed and will be incorporated in a later report.

SUMMARY

King Salmon

1. A total of 1,148 king salmon was captured at two tagging sites, Middle Mouth and Flat Island, of which 724 were tagged and released.
2. A total of 241 or 33.0 percent of the total tags out were recovered in the commercial and subsistence fisheries.

Table 7. Numbers of Yukon River Chum Salmon Tagged and Captured During 1967.

Date	Flat Island 1967			Middle Mouth 1967			Combined Sites		
	Tagged	Untagged	Total	Tagged	Untagged	Total	Tagged	Untagged	Total
June 5	1	0	1				1	0	1
6	2	0	2				2	0	2
7									
8	1	0	1				1	0	1
9									
10									
11									
12	3	1	4	0	1	1	3	2	5
13	3	1	4				3	1	4
14	1	1	2				1	1	2
15	4	6	10				4	6	10
16				0	1	1	0	1	1
17									
18	6	3	9	6	5	11	12	8	20
19	2	0	2	3	0	3	5	0	5
20				1	0	1	1	0	1
21	12	14	26	1	0	1	13	14	27
22	6	7	13	1	0	1	7	7	14
23	5	6	11				5	6	11
24	51	41	92	1	5	6	52	46	98
25	62	81	143	36	7	43	98	88	186
26	17	38	55	43	25	68	60	63	123
27	29	25	54	45	61	106	74	86	160
28	35	63	98	6	6	12	41	69	110
29	15	27	42	6	15	21	21	42	63
30	3	9	12	0	20	20	3	29	32
July 1	18	6	24	2	3	5	20	9	29
2	49	84	133	7	14	21	56	98	154
3	7	25	32	2	3	5	9	28	37
4	10	31	41	3	9	12	13	40	53
5	6	36	42	5	14	19	11	50	61
6	1	15	16	2	4	6	3	19	22
7	4	27	31				4	27	31
8	1	11	12				1	11	12
9	3	15	18				3	15	18
Total	357	573	930	170	193	363	527	766	1293

Table 8. Recoveries of Yukon River Tagged Chum Salmon by Area
1967

<u>Area of Recovery</u>	<u>Mileages from Tagging Site</u>	<u>No. of Recoveries</u>
<u>SOUTH MOUTH</u>		
Below Flat Island		
Flat Island Tagging Site	0	3
Flat Island - Alakanuk	1 - 11	1
Alakanuk	17	-
Kwiguk-Emmonak	24	2
Apokra - Kwikpak Passes	30 - 43	2
<u>MIDDLE MOUTH</u>		
Snotty Slough	20	
Apokra Pass	35	
<u>MAIN RIVER</u>		
Fish Village	52 - 63	6
Mouth, Andreafsky River	104	1
Pilot Station	122	3
Ohagamut	185	1
Russian Mission	213	3
Holy Cross	279	1
Anvik & Vicinity	317-366	1
Nulato	484	1
Ruby	581	1
Rampart		
<u>PORCUPINE RIVER</u>		
Old Crow	1259	1
TOTAL RECOVERIES		27

3. The recovery rates for salmon tagged at the Middle Mouth site was 37.0 percent compared to 30.0 percent for salmon tagged at the Flat Island site. Recoveries of Middle Mouth tags were randomly distributed among catches for various areas of the river, while Flat Island tags were not.
4. Several factors that probably affected tag recoveries are differential tagging mortality, distribution and amount of fishing (recovery) gear and timing of the runs at each site.
5. Tag recovery data indicated that the early segment of the king salmon run was not bound for the upper portion of the drainage. There was no relationship between number of recoveries and tagging period for those recoveries made in the upper river (above Mile 484).
6. Tagged salmon were classified as to their condition (1:good, 2:fair or questionable, 3:poor) upon release. Salmon classified as Condition 2 and 3 had lower upstream recovery rates (22.3 and 19.4 % respectively) when compared to the Condition 1 group (27.6%). This indicated greater mortalities for the Condition 2 and 3 groups.
7. Population estimates (Petersen method) using different sets of data varied from 397,000 to 600,000 king salmon for 1967. These estimates are believed to be high due to suspected biases such as small numbers tagged and recaptured, non-randomness of tagging and recovery effort, unreported tag recoveries and mortality of tagged fish.